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(71) Applicant *(for all designated States except US)*: RAVAGLIOLI S.P.A. [IT/IT]; Via 1° Maggio, 4, I-44044 Pontecchio Marconi (IT).

(72) Inventor; and

(75) Inventor/Applicant *(for US only)*: MANGANELLI, Fausto [IT/IT]; Via Boccherini, 13, I-40033 Casalecchio di Reno (IT).

(74) Agent: DALL'OLIO, Giancarlo; Invention S.n.c., Via del Cestello, 13, I-40124 Bologna (IT).

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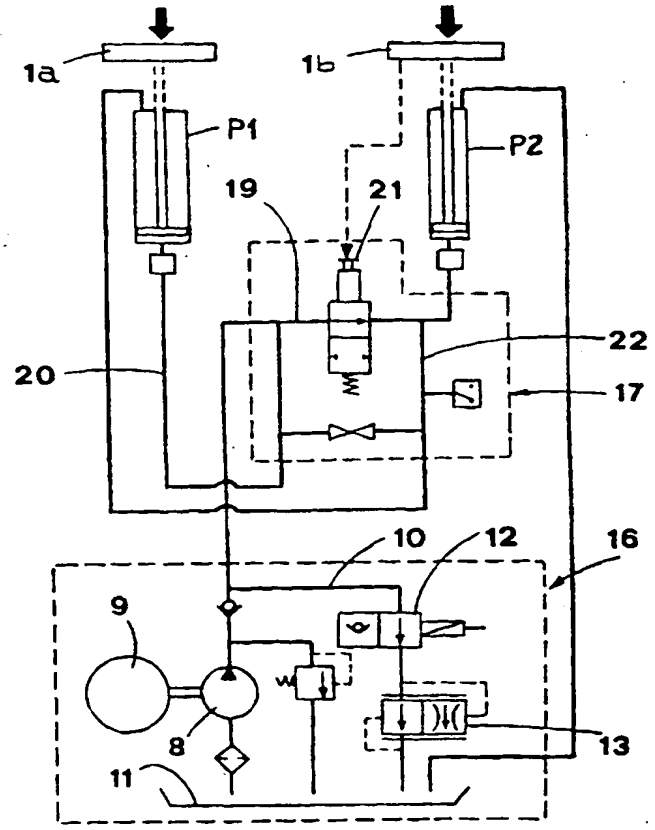
(54) Title: ELECTROHYDRAULIC LIFTING DEVICE FOR MOTOR VEHICLES

(57) Abstract

The electrohydraulic lifting device for motor vehicles includes a pair of support platforms (1), respectively a first support platform and a second support platform, which are horizontal and parallel to each other, and mounted on respective tie rods (2) respectively actuated by a main cylinder (P1) and by a secondary cylinder (P2) fed by the same main cylinder (P1), under the control of a hydraulic control unit (16). The hydraulic control unit (16) is equipped with a synchronisation device (17) including a synchronization valve (18) aimed at connecting a hydraulic media conduit (20), delivering hydraulic fluid to the said main cylinder (P1), with a recycling conduit (22) leading a suitable volume of hydraulic fluid from the same main cylinder (P1) to the secondary cylinder (P2), so that to compensate the inadequacy of the delivery of fluid to the secondary cylinder (P2), or alternatively aimed at deviating an exceeding part of the recycled fluid to a discharge, respectively at the starting and when the support platforms (1) are getting into alignment at the floor level.



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ELECTROHYDRAULIC LIFTING DEVICE FOR MOTOR VEHICLES

TECHNICAL FIELD

The present invention relates to the technical field concerned with devices used to lift motor vehicles.

BACKGROUND ART

Presently, it is known to use electrohydraulic devices which allow to lift motor vehicles up to a height that is suitable to make their lower part accessible.

Particularly there are known devices, so called scissor lifts, that are adapted to be fixed to the floor or to be set in a properly prepared seat.

As it is shown, for example, in Fig. 1a,1b and 2, the above mentioned devices basically include a pair of support platforms 1 that are horizontal and parallel to one another, these support platforms being long enough to hold the vehicle to be lifted.

The support platforms 1 are mounted on pairs of tie rods 2 which are hinged to one another at their midpoint, like a scissor, while respective cylinders 3 are connected to them.

If the lifting device is fixed to the floor, there will be provided sloped tracks 4 aimed at permitting a vehicle to run over the support platforms 1.

To give safety, the support platforms are also equipped with stops 5,6 at their ends.

In the above mentioned devices, the problem

arises that concerns the synchronisation of the support platforms movements, in any operation conditions.

In fact, the support platforms are not bound to each other, and they are mounted independently from each other, so that the space defined between them is left free and accessible.

For this purpose the support platforms are moved by means of a hydraulic control unit that has the task of controlling the supply and discharge of the hydraulic pressure media to and from the respective cylinders, as it is shown in the diagram in Figure 3.

For shake of clarity, in this diagram P1 and P2 respectively indicate the main cylinder and the secondary cylinder of the support platforms, while the support platforms are indicated by 1a, the former, and 1b the latter.

The main cylinder P1 is supplied, via the conduit 7, with fluid coming from the pump 8 that is operated by a motor 9.

A branch 10 starts from the conduit 7, downstream of the pump 8, and serves as a return way for the hydraulic media to the reservoir 11. The branch 10 includes the solenoid valve 12, activated during the lowering stage, and the flow rate adjustment valve 13.

The main cylinder P1, in its turn, feeds the secondary cylinder P2 via the conduit 14. Both the main cylinder and the secondary cylinder are equipped with respective cutoff valves 15.

Feeding the main cylinder P1 causes a certain volume of hydraulic media to flow from this cylinder to the secondary cylinder P2 that is in this way also fed.

It must be noted that the secondary cylinder

P2 has a cross section reduced with respect to the main cylinder P1, that is, the cross section of the inner chamber of the secondary cylinder P2 has the same area as the working cross section area of the inner chamber of the main cylinder P1, i.e. the area calculated taking into account the presence of the stem therein.

In this way the volume of fluid that is displaced to the secondary cylinder P2 theoretically is equal to the volume of fluid delivered to the main cylinder P1, so that like displacements occur for both the support platforms.

The volume of fluid that is first displaced from the main cylinder P1 to the secondary cylinder P2 returns than back to the main cylinder P1 in the discharge stage, that is when the support platforms are lowered.

In this stage the fluid that is contained in the main cylinder is instead discharged into the reservoir 11, because of the opening of a solenoid valve 12.

Generally, a synchronical motion is not always assured for the two support platforms, particularly because of small leakages of the fluid through the seals of the plungers of the cylinders. These leakages may cause a variation of the volume of fluid that is displaced, and consequently the synchronical motion of the platforms can be lost.

If the volume of the fluid supplied to the cylinder P2 is increased, then e.g. in the discharge stage the plunger of this cylinder will not return to the correct position, and this would provoke a nonalignment of the support platform when they are at the floor level.

If the volume of the fluid supplied to the cylinder P2 decreases, then the support platforms

remain at different height, that is the first support platform 1a is at an higher level than the second support platform 1b.

Furthermore, usually at the starting the second cylinder P2 is delayed with respect to the first cylinder P1, and this is due to the compressibility of the hydraulic fluid. Because of the compressibility of the hydraulic fluid, an initial motion of the plunger of the cylinder P1 does not determine a corresponding fluid displacement but only a fluid compression, and therefore the cylinder P2 is not operated.

This delay effect is increased at the starting because this condition is the one in which the fluid is at the maximum pressure, considering a certain constant load, and because the cylinders are in an almost horizontal position, and therefore the ratio between the vertical motion of the support platforms and the motion of the plungers is the highest.

According to another known solution, the two cylinders P1 and P2 are fed independent from one another (for example, by means of a flow distributor valve) and synchronism of the two support platforms 1a,1b is obtained by means of a mechanical linkage set between the tie rods 2 (see Fig. 1a).

This expedient does not result in an optimal effect because of the considerable mechanical stress (mainly torsional stress) that affect the parts of this mechanical linkage.

DISCLOSURE OF THE INVENTION

The object of the present invention is to contrive an electrohydraulic lifting device in which

the motion of the two support platforms is kept synchronous and in which the support platforms are perfectly in alignment with each other, when they are at the floor level at the end of every working cycle. This is obtained by providing for a compensation to the compressing action of the hydraulic media at the starting.

The above mentioned object is achieved by an electrohydraulic lifting device for motor vehicles includes a pair of support platforms, respectively a first support platform and a second support platform, which are horizontal and parallel to each other, and mounted on respective tie rods respectively actuated by a main cylinder and by a secondary cylinder.

The secondary cylinder is fed by the main cylinder, under the control of a hydraulic control unit. The hydraulic control unit is equipped with a synchronisation device including a synchronisation valve (18) aimed at connecting a hydraulic media conduit, delivering hydraulic fluid to the said main cylinder, with a recycling conduit leading a suitable volume of hydraulic fluid from the same main cylinder to the secondary cylinder, so as to compensate the inadequacy of the delivery of fluid to the secondary cylinder, or alternatively aimed at deviating an exceeding part of the recycled fluid to a discharge, respectively at the starting and when the support platforms are getting into alignment at the floor level.

BRIEF DESCRIPTION OF THE DRAWINGS

The characteristic features of the invention are set out in the following description, with

particular reference to the accompanying drawings, in which:

- Figures 1a and 1b show schematic side views of a lifting device, in a raised position and in a lowered position respectively;
- Figure 2 shows a plan view of the lifting device;
- Figure 3 shows a schematic diagram of the operation facility set up for a conventional lifting device;
- Figure 4 shows a schematic diagram of the electrohydraulic operation facility set up for the lifting device made in accordance with the present invention, as it looks at the starting;
- Figures 5, 6 and 7 show the same diagram of the electrohydraulic operation facility at an intermediate raising stage, at an intermediate lowering stage and when they are getting in mutual alignment on the floor, respectively.

BEST MODE OF CARRYING OUT THE INVENTION

Having reference to the above mentioned figures 4,5,6 and 7, the electrohydraulic control unit 16 of the subject lifting device, includes a synchronisation device 17 that is aimed at keeping the synchronism of the motion of the two support platforms 1a and 1b.

This synchronisation device 17 is equipped with a mechanically operated valve 18 that is mounted on an auxiliary conduit 19 through which the hydraulic media is delivered to the secondary cylinder P2. The auxiliary conduit 19 starts from the conduit 20 used to feed the main cylinder P1.

The normally closed two-way synchronisation valve 18 is controlled by the support platform 1b,

by means of a push rod 21.

The part of the conduit 19 downstream of the synchronisation valve 18, is connected to the recycling conduit 22 that leads the hydraulic flow from the main cylinder P1 to the secondary cylinder P2. Along the conduit 22 there is set a pressure switch 23 and a normally closed cock 24 connected to the supply conduit 20.

Operation of the device will be described in the following, beginning from the starting stage as it is shown in Figure 4.

In this stage the synchronisation valve 18 is open because of the thrust made by the support platform 1b on the push rod 21.

Therefore the hydraulic media delivered by the pump 8 to the main cylinder P1 via the conduit 20, is partially deviated to the secondary cylinder P2 via the auxiliary conduit 19.

In this way the delay in displacing the fluid from the main cylinder P1 to the secondary cylinder P2 through the recycling conduit 22, due to the compression of the fluid, is compensated by the volume of fluid directly fed to the cylinder P2, and the synchronous motion of the support platform 1a and 1b is therefore assured.

The raising motion of the support platform 1b causes the synchronisation valve 18 to close, so that afterwards, during the raising motion of the support platforms, the conduits 20 and 22 are no longer connected to each other. Then, the secondary cylinder P2 is supplied only with the fluid displaced from the main cylinder P1 through the recycling conduit 22 (See Figure 5).

In a similar way, when the support platforms are lowering, since the synchronisation valve 18 is closed, the fluid present into the secondary cylin-

der P2 flows back to the main cylinder P1 only through the recycling conduit 22 (see Figure 6).

The fluid used to actuate the main cylinder P1, is instead sent to the reservoir 11 through the conduit 10 after that the solenoid valve 12 has been properly opened.

When the support platforms reach the floor level, the support platform 1b provokes again opening of the synchronisation valve 18, so that the fluid from the secondary cylinder P2 also flows through the auxiliary conduit 19 (see Figure 7).

In this way, hydraulic fluid in excess, due to possible leakages, is directly discharged into the reservoir 11. On the contrary, a possible inadequacy of the fluid present in the main cylinder P1 is compensated by deviating a part of the fluid being discharged from the same main cylinder P1, to the recycling conduit 22.

The support platform 1b keeps the synchronisation valve 18 open through a rising stroke of about 10 mms.

In the lifting device just described, the problem of keeping the support platforms in alignment when at floor level at the end of every working cycle, is therefore solved. Also the problem of maintaining the synchronism of the two support platforms at the starting stage, due to the fluid compressibility, is solved.

It is understood that what has been described above is only illustrative, therefore possible constructive variants are within the protection of the present invention as described hereinabove and claimed in the following.

CLAIMS

1. Electrohydraulic lifting device for motor vehicles, including a pair of support platforms (1a,1b), respectively a first support platform and a second support platform, which are horizontal and parallel to each other, these support platforms (1a,1b) being mounted on respective tie rods (2) and respectively set in motion by a main cylinder (P1) and a secondary cylinder (P2) that is fed by the main cylinder (P1), under the control of an electrohydraulic control unit (16), the said lifting device being characterised in that the said electrohydraulic control unit (16) is equipped with a synchronisation device (17) including a valve (18) aimed at connecting a hydraulic media conduit (20), delivering hydraulic fluid to the said main cylinder (P1), with a recycling conduit (22) leading a suitable volume of hydraulic fluid from the same main cylinder (P1) to the said secondary cylinder (P2), or alternatively aimed at deviating an exceeding part of the recycled fluid to a discharge, respectively at the starting and when the support platforms (1a,1b) are getting into alignment at the floor level.

2. Device as claimed in claim 1, characterised in that the said synchronisation valve (18) is mechanically operated, either to get open or closed, as a consequence of the lowering or raising of the said support platform (1b) respectively.

3. Device as claimed in claim 1, characterised in that the said synchronisation valve (18) is set along an auxiliary conduit (19) that is aimed at delivering the hydraulic fluid to the said secondary cylinder (P2) and that starts from said delivery

conduit (20) leading to the said main cylinder (P1), said auxiliary conduit (19) being connected to a part of the said recycling conduit (22) located downstream of the said synchronisation valve (18).

4. Device as claimed in claim 1, characterised in that in normal operation, when the said support platforms (1a,1b) are raising or lowering, the said synchronisation valve (18) is normally closed, so that the said delivery conduit and the said recycling conduit (22) are not connected with each other, and the said secondary cylinder (P2) is fed only with the hydraulic fluid coming from the said main cylinder (P1) through the said recycling conduit (22).

5. Device as claimed in claim 1, characterised in that when the support platforms are getting into alignment at the level floor, inadequacy of the recycling fluid present in the said main cylinder (P1) is compensated by deviating a part of the fluid being discharged from the same main cylinder (P1), to the recycling conduit (22).

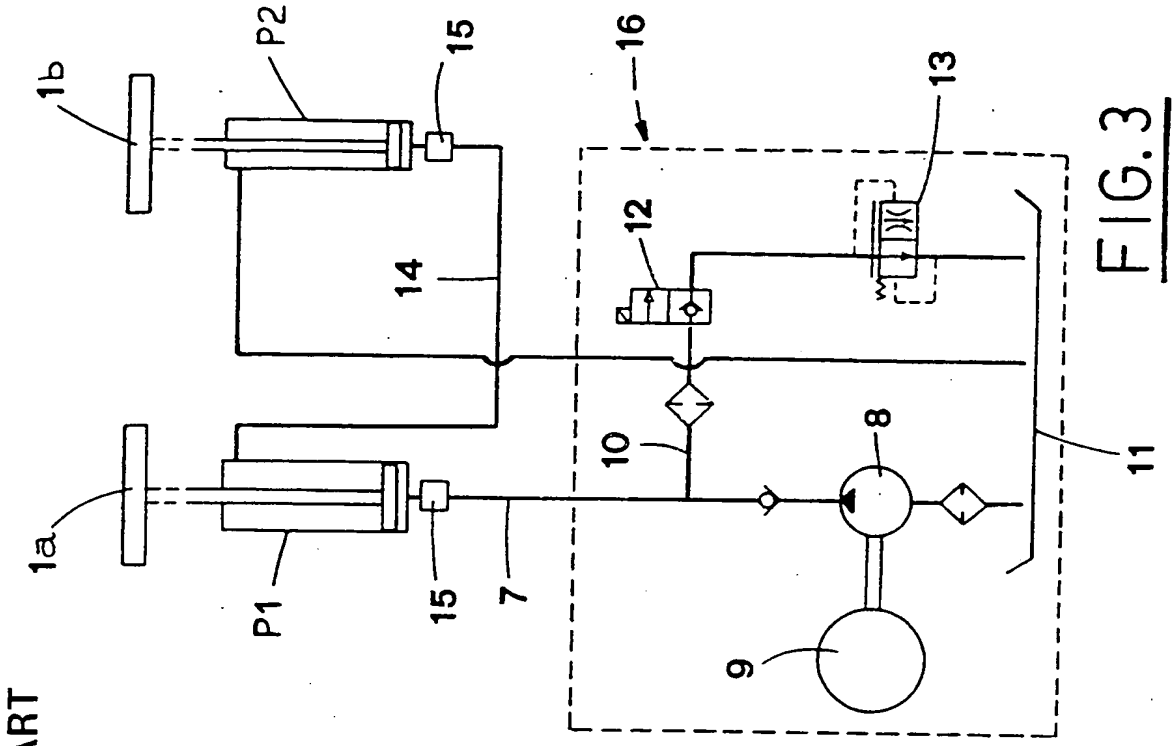

FIG. 3

PRIOR ART

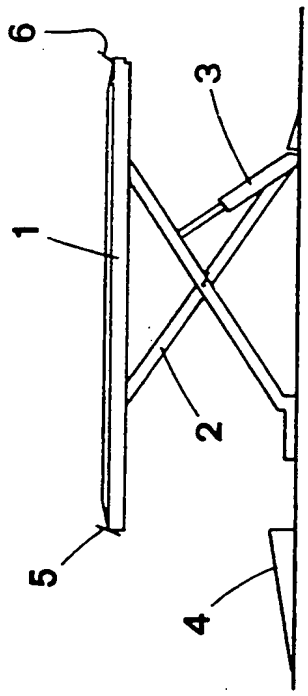

FIG. 1a

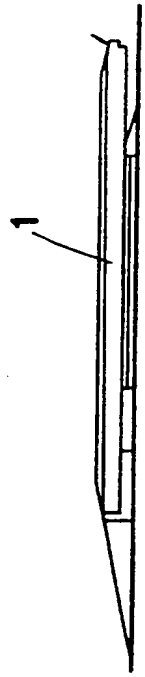

FIG. 1b

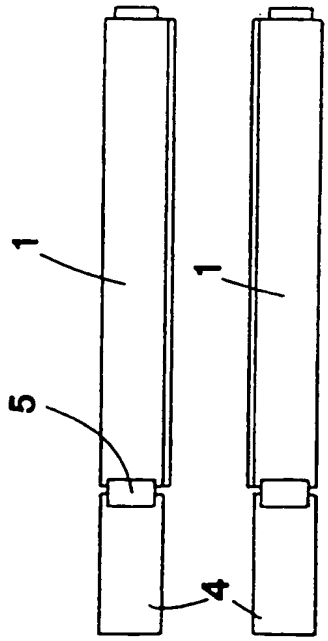

FIG. 2

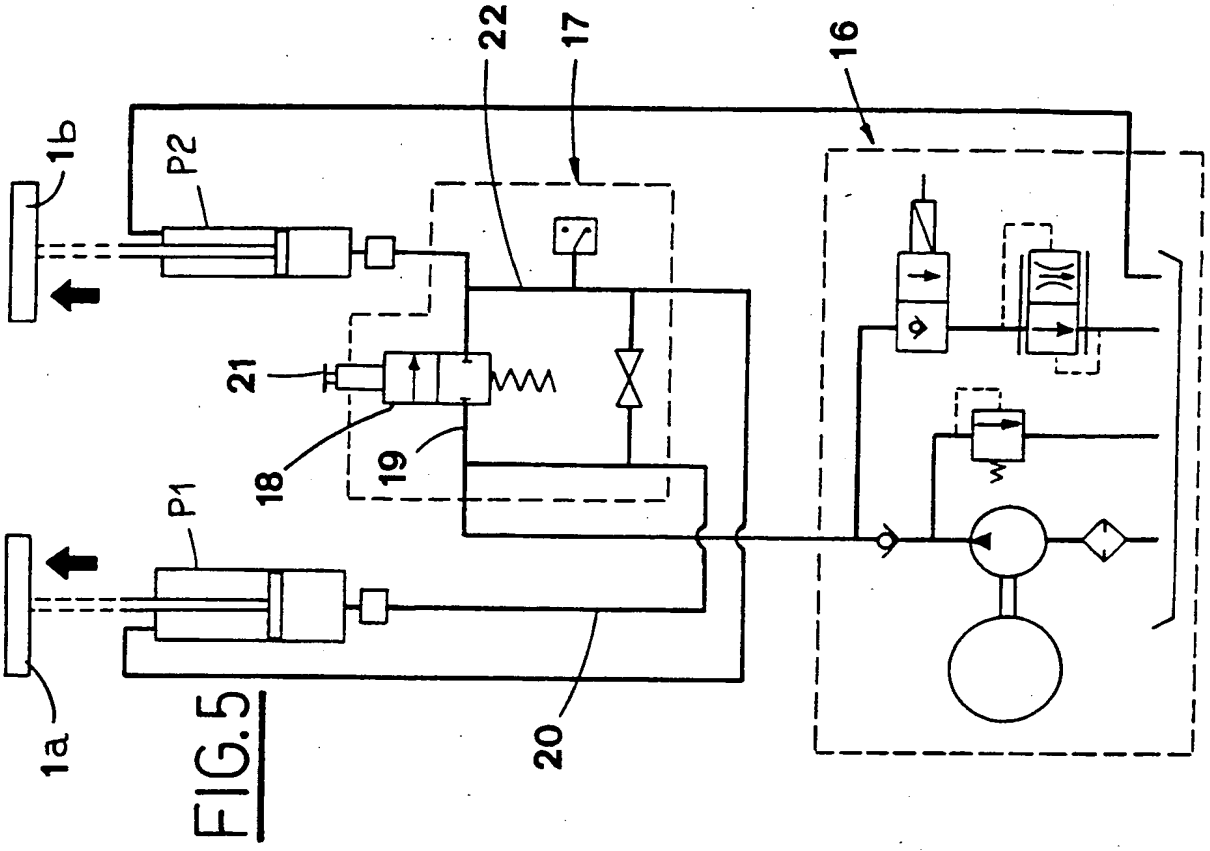

FIG.5

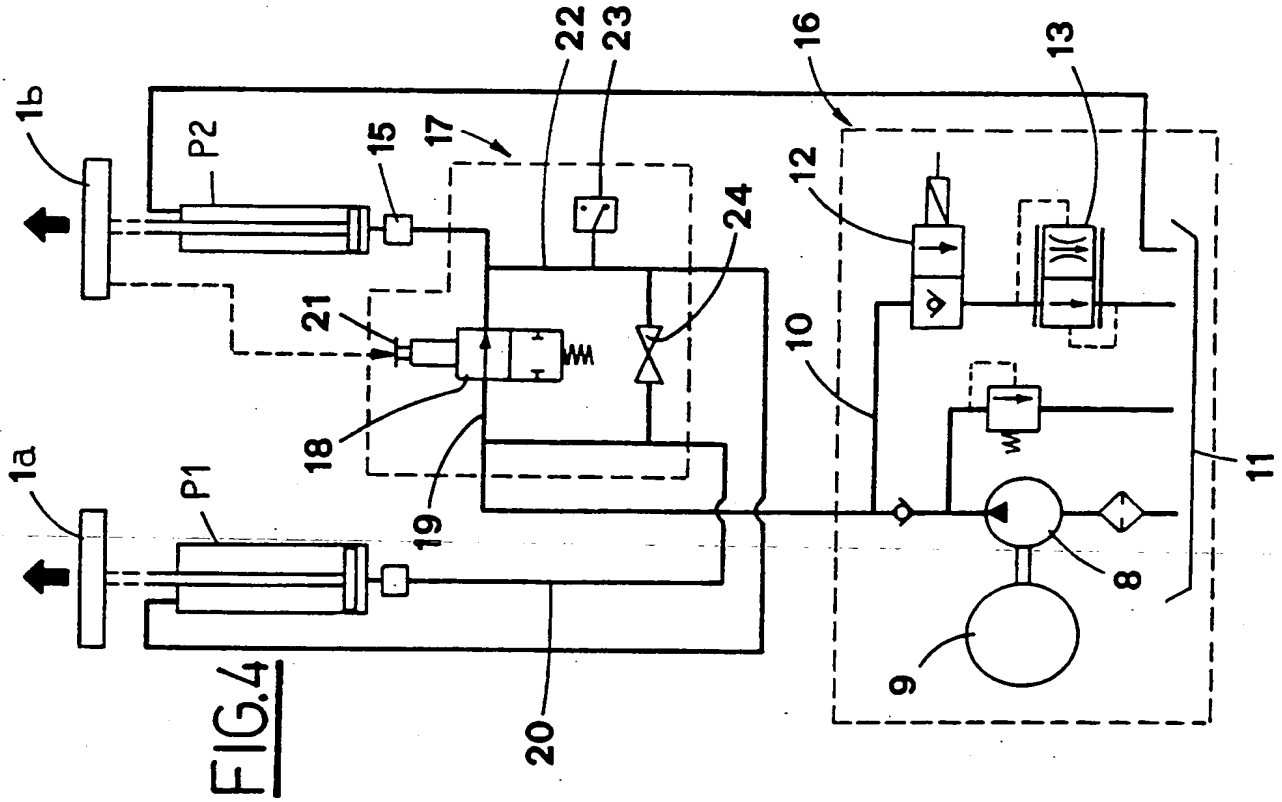

FIG.4

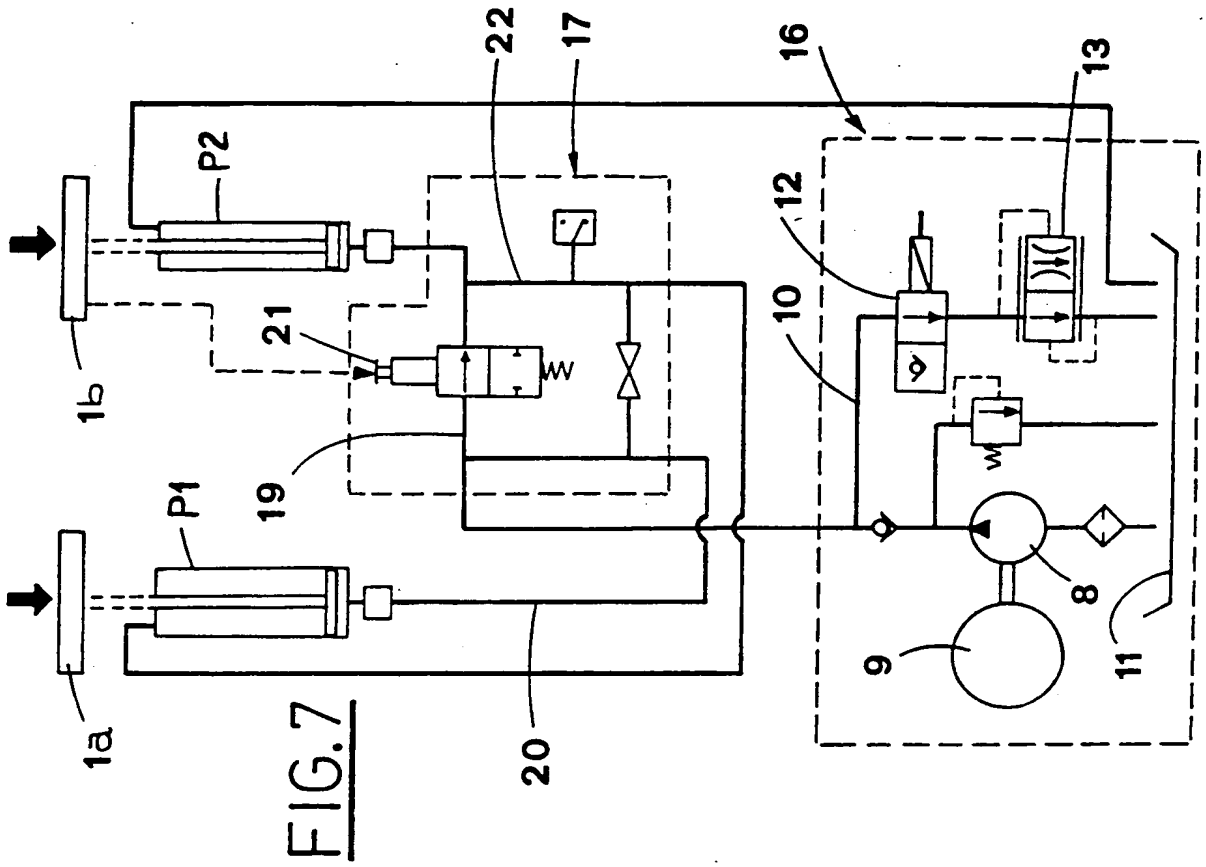

FIG.7

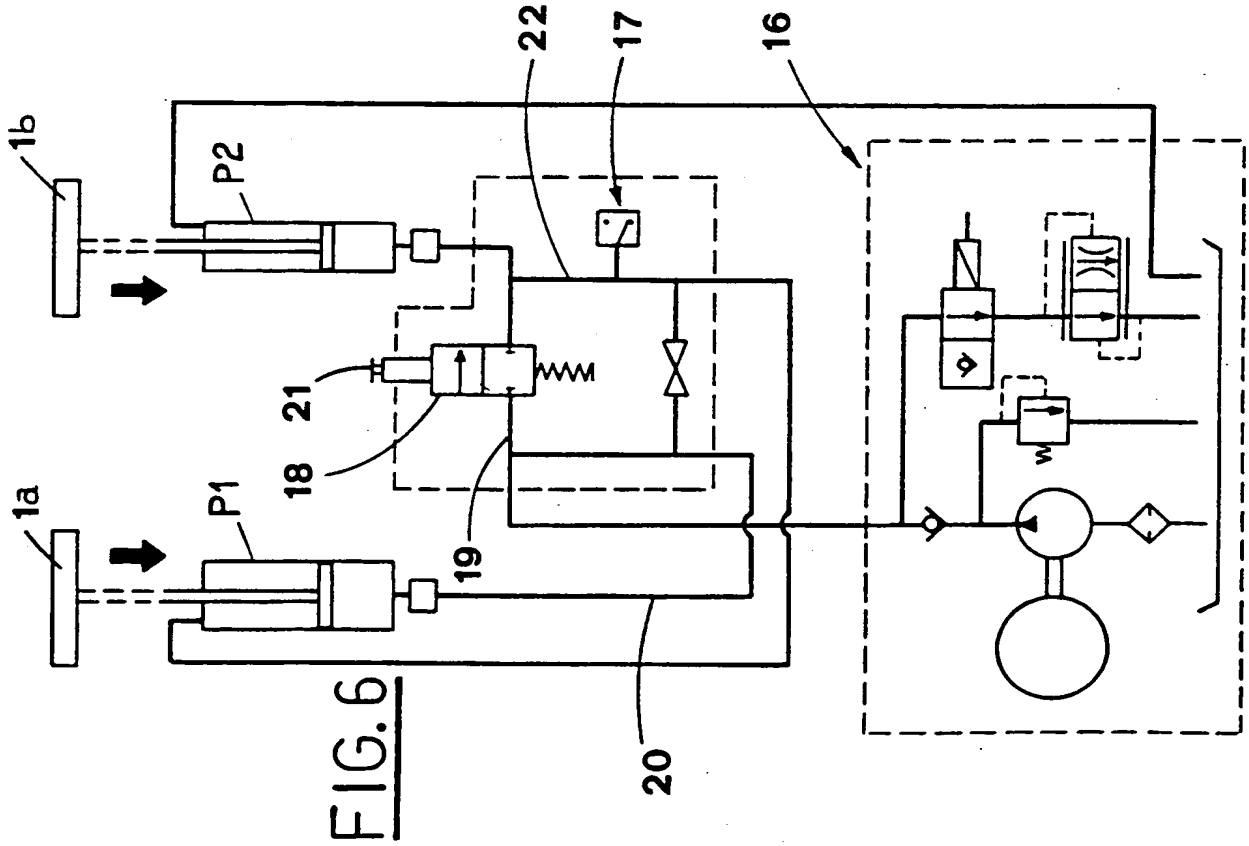

FIG.6

INTERNATIONAL SEARCH REPORT

Interr. al Application No
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A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 B66F7/20 B66F7/08 F15B11/22

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 B66F F15B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE,A,34 39 292 (OTTO NUSSBAUM & CO.) 7 May 1986 see page 5, paragraph 4 - page 7, paragraph 1	1-4
X	US,A,5 072 649 (LAGHI) 17 December 1991 see abstract; figure	1,3-5
X	EP,A,0 566 203 (STERTIL) 20 October 1993 see the whole document	1,3-5
A	FR,A,1 575 128 (CASCADE CORP.) 18 July 1969	

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US-A-5072649	17-12-91	NONE		
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